DOCUMENT RESUME

ED 289 604 PS 017 038

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TITLE Exploring the Indirect Routes by Which Maternal Speech Predicts Later Child Language Development.
PUB DATE Oct 87
NOTE 28p.; Paper presented at the Annual Boston University Conference on Child Language Development (12th, Boston, MA, October 23-25, 1987).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Child Language; Correlation; Infants; *Language Acquisition; Longitudinal Studies; Mothers; *Parent Child Relationship; *Predictor Variables; *Research Design
IDENTIFIERS Child Influence; *Indirect Effects (Causal Modeling)

ABSTRACT

Since research indicates that young children influence their mothers and that mothers may exert indirect influences on their children's language learning, this correlational, longitudinal study was conducted to identify indirect routes through which early maternal speech was related to later child language development. Participants were 10 children in Brown's early stage 1 of language learning and the children's mothers. Mean chronological age of the children when the study began was 22 months; their mean length of utterance was 1.13. For each mother and child dyad, two free-play sessions occurring 5 months apart, here called time 1 and time 2, were videotaped in the subjects' homes. Pragmatic language use by mothers was coded from time 1 sessions. Child language level was coded at both sessions. Findings indicated that six of the eight correlations between mother interaction style and later child language development could be explained through a common relation with a child language variable at time 1. Results indicated that a mother-driven, direct influence model may be inappropriate for many mother speech-child language development relationships. Concluding remarks present logical arguments demonstrating that child-driven and mother-driven models explaining the indirect relationships are equally feasible. (RH)

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Exploring the Indirect Routes by Which Maternal Speech Predicts Later Child Language Development

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PS 017038

Paper presented at the Boston University Conference on Language Development, October, 23 - 25, 1987.

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Abstract

The present study analyzed formally unexamined indirect routes for relationships between time 1 maternal speech and later child language development. Ten stage 1 children and their mothers were the subjects. For each dyad, two free-play sessions occurring 5 months apart were videotaped in the subjects' homes. Mother's pragmatic language use was coded from time 1 sessions. Child language level was coded at both sessions. Even though time 1 scores of the outcome were controlled, seven out of the nine obtained mother speech - child language development relationships were mediated through one of two time 1 child language measures. The results indicate that a mother-driven, direct influence model may be inappropriate for many mother speech - child language development relationships. The authors present logical arguments demonstrating that child-driven and mother-driven models for explaining the indirect relationships are equally feasible.

For over a decade, researchers have used correlational, longitudinal designs to identify aspects of mother speech that may facilitate child language development (Snow, 1984). Past analyses of these relationships have looked only at the correlation between time 1 mother speech variables and time 2 child language development variables.

Using this seemingly straightforward way of investigating such relations implicitly assumes a mother-driven direct influence model. That is, it is mother-driven because variation among the way mothers talk to their children is posited to be partly responsible for variation in child language development. It is a direct influence model because no mediating variable is posited. Substantively, the absence of a mediating variable means that the proposed influence on language development involves child analysis of the specific type of maternal utterance.

As an example of a mother-driven direct influence model, some researchers have posited that one reason children vary in their rate of language development is because advanced children have mothers who frequently use utterances that are particularly rich in analyzable linguistic information. The target type of maternal utterances may be more salient and therefore analyzable because they are temporally and semantically contingent on their children's behavior or because they require a child response. By linguistically rich, I mean these target utterances may contain a high number of examples of the linguistic structure that the child is ready to learn. Those children who have more analyzable information available to them learn language more quickly.

Many researchers have acknowledged that these time 1 - time 2 correlations may not indicate direct or unidirectional maternal influence

(Barnes, Gutfreund, Satterly, & Wells, 1983). But evidence supporting indirect maternal influence or child influence models have not been forthcoming.

Mother speech at time 1 may be related to child language development at time 2 through covarying, usually unexamined, variables. This covarying variable may exist outside the mother-child dyad, be another mother variable, or be a child variable.

The present study will examine some of these indirect routes. We will use a correlational, longitudinal design, but add analyses for indirect effects to the usual analyses for direct effects. Therefore, the design is not adequate to demonstrate causality or to identify one best explanatory model for the results. But identifying indirect routes through which time 1 maternal speech is related to later child language development is useful in showing the need for more complex explanations for time 1 - time 2 relations. That is, demonstrated indirect routes may reduce the probability of prematurely accepting mother-driven direct influence models to explain time 1 - time 2 relations. Given the scientific principle of favoring the simplest model that fits the data, collecting more data is often necessary to determine if more complex explanations are worth investigating. The present data will demonstrate that indirect models of influence are indeed worthy of investigation.

The present study only examined indirect routes involving child language variables at time 1. Covarying time 1 child variables were examined for two theoretically important reasons. First, a decade of mother-child interaction research tells us that children effect mothers as well as mothers effecting children. Therefore, we wanted to examine whether there was evidence of a

possible child influence that could account for time 1 - time 2 relationships. Second, mothers may have an indirect influence on children's language learning by effecting the general frequency with which their children analyze language or participate in conversations. Neither of these indirect models has been tested.

Olsen-Fulero's (1982) model of facilitating and impeding conversation styles was selected as the basis for generating an empirical example for studying these relationships.

Briefly, Olsen-Fulero (1982) posited that mothers use several types of questions to elicit child conversation. She found that requests for unknown information (i.e., real questions) and requests for confirmation (i.e, verbal reflective questions) covaried with each other (McDonald & Pien, 1982), were stable across time (Olsen-Fulero, 1982), and were highly likely to elicit a child response (Olsen-Fulero & Conforti, 1982). Hoff-Ginsberg (1986) found that these types of questions did in fact positively predict later language development.

In contrast, Olsen-Fulero (1982) posited that directives, conversational dominance, and questions with high constraints (e.g., test questions) impeded child conversation. They may do so because they elicited mostly nonverbal or rote, single word responses. She found these behaviors were positively correlated with each other, but negatively correlated with conversation-eliciting questions (McDonald & Pien, 1982). Several investigators found that high use of directives were negatively associated with rate of later language development (Olsen-Fulero, 1982 for review).

If these maternal behaviors do predict later language development, they <u>could</u> do so by way of a child language variable at time 1. That is, the

mother speech variable at time A may be related to later child language development because both of these variables are related to some child variable at time A. In the present design, the fact that the time variables were coded from the same interaction session means that we can't be sure whether it is the mother or the child who is the primary agent of influence.

One possibility is that the mother is partly responsible for variation in child language development. This maternal influence may be exerted on the child immediately or it may have occurred before the time A session took place.

When immediate maternal influence occurs at time A, mothers influence the frequency, content, and complexity of the child's conversation through their conversational style as may be seen in types of maternal questions, statements, and feedback. In turn, children who are encouraged to talk more often may elicit more analyzable language models and elicit feedback on their language use which in turn may facilitate later language learning. Immediate maternal influence can be assessed through a sequential analysis during the time A session. The relation between child language at time A and time B can be evaluated through correlational analysis between these two summary level measures.

Although we can't directly test this next model with our design, we acknowledge that it is a possible explanatory model for indirect maternal influence. In this model the mother's influence may be occurring before one collects the time A session. We've called this model latent cumulative influence because the time of initial influence is not observed and the hypothesized influence occurs repeatedly over time. As an example, one can imagine that a maternal style that requests the child's frequent

participation in conversation may put the child on the spot to use more complex language than he presently has. The discrepancy may motivate the child to analyze language more frequently. More frequent general analysis of adult language may lead to subsequent development of syntactic and lexical skills. If variation in maternal style and child language development is somewhat stable over time, then a correlation between summary level measures of maternal style at time A and later child language development could occur.

It is also quite possible that the children are responsible for the correlation between variation in time A maternal style and later rates of child language development. We call this a child-driven, common cause model. Once again, this child influence may be exerted immediately during the time A session.

In this example, children who talk frequently about interesting topics using complex sentences may immediately elicit maternal follow-up questions. Additionally, variation in the complexity of child language may be stable over time. In this way, variation in maternal question asking could be correlated with later child language development without actually causing it.

It is also possible for the child influence to have occurred before we measured the time A session. In interactions taking place before the session A occurs, the mother learns that her child is capable complex language production . Later, in session A, she frequently elicits conversation that requires complex language through certain question types. If variation in child syntactic level is stable across time, there will be a correlation at time A without immediate influence. Early differences in syntactic development may predict early auxiliary development so maternal question asking at time A may appear correlated with later auxiliary development

without causing it. Once again, this complex model is not one that we can test with our present design, but we acknowledge it as a possible explanatory model for indirect relations.

Therefore, this study was designed to accomplish two objectives. First, we sought to test our hypotheses about the existence and direction of relations between Time A maternal speech and child language development. Second, we carried out analyses to examine several time A child language variables that may help explain why time A maternal variables correlate with later child language development.

Method

The data for the present study was selected from Ann Kaiser's longitudinal study of mother-child interaction. The first session was the first interaction session in which the children emitted at least 50 intelligible utterances and were in Brown's early stage I of language learning.

This resulted in selecting 10 children with a mean child CA of 22 months (*SD* = 4) and a mean MLU of 1.13 (*SD* = .11). The children were of normal intelligence (*M* = 123; *SD* = 14). All were Caucasian. The mothers were all the primary caregivers of their children, none were employed outside the home, and all were in working class homes.

The second session occurred 5 months after the initial session. Both mother-child freeplay sessions occurred in the mothers' homes. They lasted for 20 minutes and were videotaped for later transcription and coding. The instructions to the mother were simply to play with her child and the developmentally appropriate toys as she ordinarily would.

Later, the sessions were transcribed and coded. Interobserver agreement of transcription was 98% on mother utterances and 89% on child utterances. Interobserver reliability on the following coded variables averaged above .85. The following variables were coded from the transcript and videotape.

Place Table 1 about here.

Table 1 defines the potential maternal predictors coded from the first sessions as those stated in the hypotheses. That is, real and confirmation questions were the proposed positive predictors. Directives, test questions and conversational dominance were the proposed negative predictors.

Place Table 2 about here.

The potential covarying child variables that were measured at time 1 are those listed in Table 2. As is illustrated, we coded several measures of several aspects of language use. Selected variables were those that others have reported change in Brown's late stages I and II. Child responsiveness to the target types of maternal questions were also coded because we thought responsiveness to these question types may influence how often mothers use them.

Place Table 3 about here.

Table 3 lists the selected measures of child language development. There are a subset of the child language variables that we measured at time A. This

subset met two criteria. First, the variable scores increased from time A to time B. Second, the variables allowed statistical or design control of time A child differences on the measure at time B. That is, and this is important, all measures of child language development were statistically independent of the time A form of that measure. This was accomplished in two ways. First, if the time A measure was correlated with the time B measure, residualized gain scores were formed. In cases where no stability in the measure was seen, the time B scores were used only if the time A scores showed little or no occurrence. For example, eight of the ten subjects gave no instances of copula verbs at time A. The remaining two gave 1 and 2, respectively. Therefore, occurrence in copula verbs at time B was clearly statistically independent of occurrence of copulas at time A. It is important that our time B measures were independent of their time A scores because it is commonly assumed that these two methods for "controlling for individual differences in child language at time A" will sufficiently control the spurious influence of the child at time A.

Results and Discussion

Three sets of analyses were carried out. First, to test the hypotheses about the predictive value of the maternal time A variables, maternal variables were correlated with later child language development variables.

To examine the possibility that these relationships were due to covarying relations with time A child variables, a two step procedure was carried out. First, the measures of child language development that were predicted were correlated with the set of child variables measured at time A. If any of the time A child variables were significantly correlated with the predicted language development measures, they were correlated with the

maternal predictors. Child variables at time A that related to both the relevant maternal predictor and the predicted language development variable constituted covarying child language variables.

To reduce redundancy produced by measures that index the same construct, intercorrelation matrices within each set of variables were examined. Once identified, redundant measures are dropped from further discussion.

Using this many tests of significance will result in some chance correlations with p values less than .05. Therefore, the specific results should be interpreted with caution. Replication of these results is necessary before one can safely interpret specific correlations as reliable estimates of relations that occur in the population.

Place Table 4 about here.

Table 4 indicates the significant correlations between Time A maternal interaction style and later child language development. Real questions and confirmation questions are positive predictors of at least one aspect of child language development, as predicted. While test questions and directives are negatively related to child language development, as predicted. However, conversational dominance is not related to child language development. As indicated on the table's footnote, seven of the nine relations showed evidence of being an indirect relation.

Place Figure 1 about here.

After eliminating redundant variables on the basis of their intercorrelation matrices, there were eight significant correlations between maternal predictors and child language development variables (see Figure 1). Six of these eight could be explained through common relations with two time 1 child variables. For example, real questions were related to gains in MLU through child responsiveness to confirmation questions at time 1. Confirmation questions were related to gains in copula use through the percentage of child multiword utterances at time 1.

After controlling for the covarying time A variable, the relations between maternal predictors and later language development were rendered nonsignificant. The small sample size poses problems for interpreting this finding. But, the presence of these covarying child variables at time 1 will clarify how these six relations could be caused by variation in the children as well as the more popular explanation that mothers cause variation in the children's development.

None of the variables within the set of maternal predictors, child covarying variables and child outcomes are positively related. In fact, besides those marked in Figure 1, the only significant correlation between these variables is a negative one between real questions and directives.

There were only two time 1 child variables that covaried with the maternal predictors and later language outcomes. The first one was responsiveness to maternal confirmation questions at time 1. We interpret this measure as a distal measure of child conversational responsiveness that is relatively independent of syntactic or lexical development. Our interpretation is based on three pieces of evidence. First, this variable was not related to any other child language variable at time 1. Second,

answering requests for confirmation are relatively easy. Our criteria for child response required only semantic relevancy, not correctness, so the child only had to indicate "yes" or "no" to respond to most confirmation requests. Third, requests for confirmation differ from other yes/no questions in that they always query the content of the child's previous utterance and thus topic of interest. Others have speculated that questions that continue the child's topic may be particularly likely to elicit conversation. Therefore, the child who does not respond to confirmation requests may fail to do so because of a lack of interest or skill in continuing the topic, rather than a lack of lexical or syntactic skill.

We interpret percentage of multiword utterances as a gross measure of syntactic level. Its signficant concurrent correlation with child MLU supports this interpretation.

The relation of the covarying time A child variables with later child language development variables may be explained by their common benefit from or cause of language analysis. For example, the relation between child responsiveness and later MLU development could be due to the notion that variation in conversational interest and skill may cause variation in language analysis. For example, greater interest and responsiveness to conversation may motivate the child begin to analyze language earlier or do so more frequently so that he/she can participate in conversations. Such frequent and early analysis may result in advanced syntactic development. The relation between time A syntactic level and later copula development could be explained in the notion that children who analyze language more frequently or effectively learn both syntactic and morphological skills. Finally, the children who analyze and attend to adult language frequently may learn to

comprehend and respond to frequently occurring adult test questions more often than other children.

It should be noted that there is no relation between percentage of multiword utterances and residualized gains in mean length of utterance. These two variables are not related primarily because, by definition, the residualized gain scores for MLU are statistically independent of syntactic level at time 1. However, note that time 1 conversational responsiveness is related to later gains in MLU. This could occur even though residualized gain scores were used because this measure of conversational responsiveness was independent of syntactic level at time 1.

Now let's turn to the more interesting possible explanations for relations existing at time A. To determine whether there was evidence of an immediate effect of the mother or child at time A, a post hoc analysis of the sequential occurrence of the length of child talk that followed or preceded the four significant maternal predictors during the time A sessions. There was no theoretical rationale for the inclusion of responsiveness to confirmation requests in these sequential analyses. In regards to maternal real and confirmation questions, we calculated the conditional probability of multiword child utterances following and preceding these positive maternal predictors. With directives and test questions, we calculated the conditional probability of a single-word child utterance preceding or following these negative maternal predictors. The statistical significance of the conditional probabilities was not calculated because our data violated the assumption of independence of observations. Such a violation prevents accurate assessment of the significance of conditional probabilities (Gardner, Hartmann, & Mitchell, 1982). However, the results of these analyses indicated that only

one conditional probability was greater than 5%. No other evidence of immediate effects was present.

The exception was the finding that an average of 49% (SD = 21) of the mothers' test questions were followed by single word utterances. This finding supports the notion that mother test questions elicit single word utterances. This may explain, at least in part, the negative relation between maternal test questions and percentage of multiword child utterances at time 1.

Therefore, if the relations occurring at time 1 represent causal ones, this influence was probably exerted through a latent cumulative influence. This influence could be exerted by the child or the mother.

Place Figure 2 about here.

For example, in addition to the aforementioned immediate influence, Figure 2 illustrates that maternal test questions may have also exerted a latent cumulative influence before the time 1 session. A latent cumulative effect model would propose that when mothers continually elicit a high proportion of test questions they may impede the child's syntactic development by requesting responses that don't stimulate the child to analyze language (i.e., rote, single word utterances). The correlation at our time 1 session may have occurred because the mothers' interaction style and child's syntactic level may have been stable over time.

Place Figure 3 about here.

Figure 3 illustrates that it is also quite possible that individual differences in the children are responsible for the negative relation of maternal test questions and directiveness with child conversational responsiveness and syntactic level at time A. Specifically, mothers may follow a specific version of the fine tuning hypothesis. This hypothesis suggests that mothers elicit the highest level of child communication that they believe their children are capable of. As mothers observe that their children show little interest or ability to converse in multiword utterances, the mothers learn that they will be most successful in eliciting mostly nonverbal and single-word utterances. The correlation at our time 1 session could have occurred if this maternal interaction style and child characteristics were stable over time.

Place Figure 4 about here.

Similarly, Figure 4 illustrates that the mothers of children who are interested and able to converse in multiword utterances may have used real and confirmation questions to encourage their children's conversation because they believed their children were capable of such conversation. Again, the correlation at time 1 could have occurred if variation in this maternal conversational style and child characteristics were stable over time.

Place Figure 5 about here.

Conversely, Figure 5 illustrates that there may have been a latent maternal influence that accounts for the positive relation between maternal

real and confirmation questions and child conversational responsiveness and syntactic level at time 1. Mothers who use a high proportion of conversation eliciting question types (i.e., real and confirmation questions) may elicit child interest in conversing which in turn leads to greater motivation in and frequency of language analysis. Again, the correlation at time 1 would be seen if variation in maternal interaction styles and child characteristics were stable over time.

The two correlations between maternal interaction style and later child language development that did not show evidence of a covarying time 1 child variable may or may not be indirect relations. The existence of unmeasured variables that may account for the relation is always a possibility of correlational designs. Additionally, a larger sample size may have resulted in finding covarying child language variables for these two relations in the set of time child variables that we did measure.

In summary, six of the eight correlations between maternal interaction style and later child language development could be explained through a common relation with a child language variable at time 1. This suggests that mother-driven direct influence models may be inadequate to explain many such correlations. The present evidence of indirect paths of influence does not preclude the possibility that mothers influence their children's language development. However, we have argued that the existence of covarying child variables at time 1 highlights the equally plausible explanation that variation in children's behavior may be responsible for such correlations. Child-driven models of influence are possible explanatory models even when residualized gain scores or variables with no occurrence at time 1 are used as child language development outcomes. In as much as it is the business of

scientists to examine alternative explanations to their results, it our business to examine the possible effect of the child on the mother, as well as complex indirect effects of the mother on the child.

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Table 1

Maternal Verbal Interaction Style Variables at Time A

Variable Name	Definition/Description	Example
Proposed positive predictors		
Requests for unknown information	Wh-requests for information the mother presumably does not know.	What happened?
Requests for confirmation	Request for the child to confirm the mother's interpretation of the child's utterance.	Did you say ball?
Proposed negative predictors		
Test questions	Wh-requests for information the mother presumably knows.	What is this? (pointing to a ball)
Directives	Instructions to do a nonverbal behavior.	Sit down.
Conversational dominance	Average number of utterances/turn	

Table 2. Child Language Variables at Time A

Variables	Definition/Description	Example
Amount of Child Talk		
Number & percent of turns child talked	A "turn" is marked by sequence and pauses over 2 seconds.	C: I want. M: A ball, you want a ball.
Total number of tokens	Two instances of one word counts as 2 tokens.	Ball, ball= 2 tokens.
Lexical Diversity		
Number of different words	"Different" defined by exact spelling of word root and meaning.	C: I can. C: can fall. (as aluminum can falls)
Number of different verbs	Irregular tense markers are counted as different from base form.	"Do" & "did" are different words.
Morphology		
Number of copulas	# of utterances w/copulas	I'm tired.
Number of auxiliaries	# of utterances w/auxiliary	I'm sleeping.
Number of different inflected words	Inflections include plurals, 's, past tense, ing, and negative contractions.	I goed. I sleeping.
Syntax		
Mean length of utterance	Brown's (1973) conventions followed.	
Number & percent of utterances w/at least 2 words		Car go.
Number & percent of utterances w/at least 3 words		Car go house.
Pragmatic		
Number of child questions asked	Questions determined by intonation & inferred intent.	What's that?
Percent of mother's test questions answered	Responses are semantically related child talk following questions.	M: What color is that? C: Red.
Percent of mother's requests for unknown information answered		M: What happened to the car? C: In house.
Percent of mother's request for confirmation		M: Did you say ball? C: Yeah.

Table 3

Child Language Development Measures

Amount of Child Talk
Percentage of spoken turns filled by child
Morphology
Number of different inflected words
Number of utterances w/copulas
Number of utterances w/auxiliaries
Syntax
Mean length of utterance
Number utterances with at least 2 words
Number utterances with at least 3 words
Percentage of utterances with at least 3 words
Pragmatics
Percentage of test questions that child answered
Number of child questions

a = residualized gain score (time 2 score with time 1 score partialled out).

Table 4

Correlations of Maternal Style at Time A and Child Language Outcomes

Child Language Outcome	Maternal Style				
	Real Questions	Conf. Questions	Test Questions	Directives	Long Turns
% Child turns					
Inflected words					
Copulas	.74** [a]	.76** [a]		-.75** [a]	
Auxiliaries			-.68*		
MLU	.74** [a]			-.80** [a]	
# 2-word utterances					
# 3-word utterances					
% 3-word utterances	.62* [a]			-.68*	
Responsiveness to test questions			-.75** [a]		
# child questions					

* $p < .05$
** $p < .01$

[a] Evidence of an indirect relation.

Figure 1

The Indirect Routes by which Maternal Time 1 Style Predicted Child Language Development

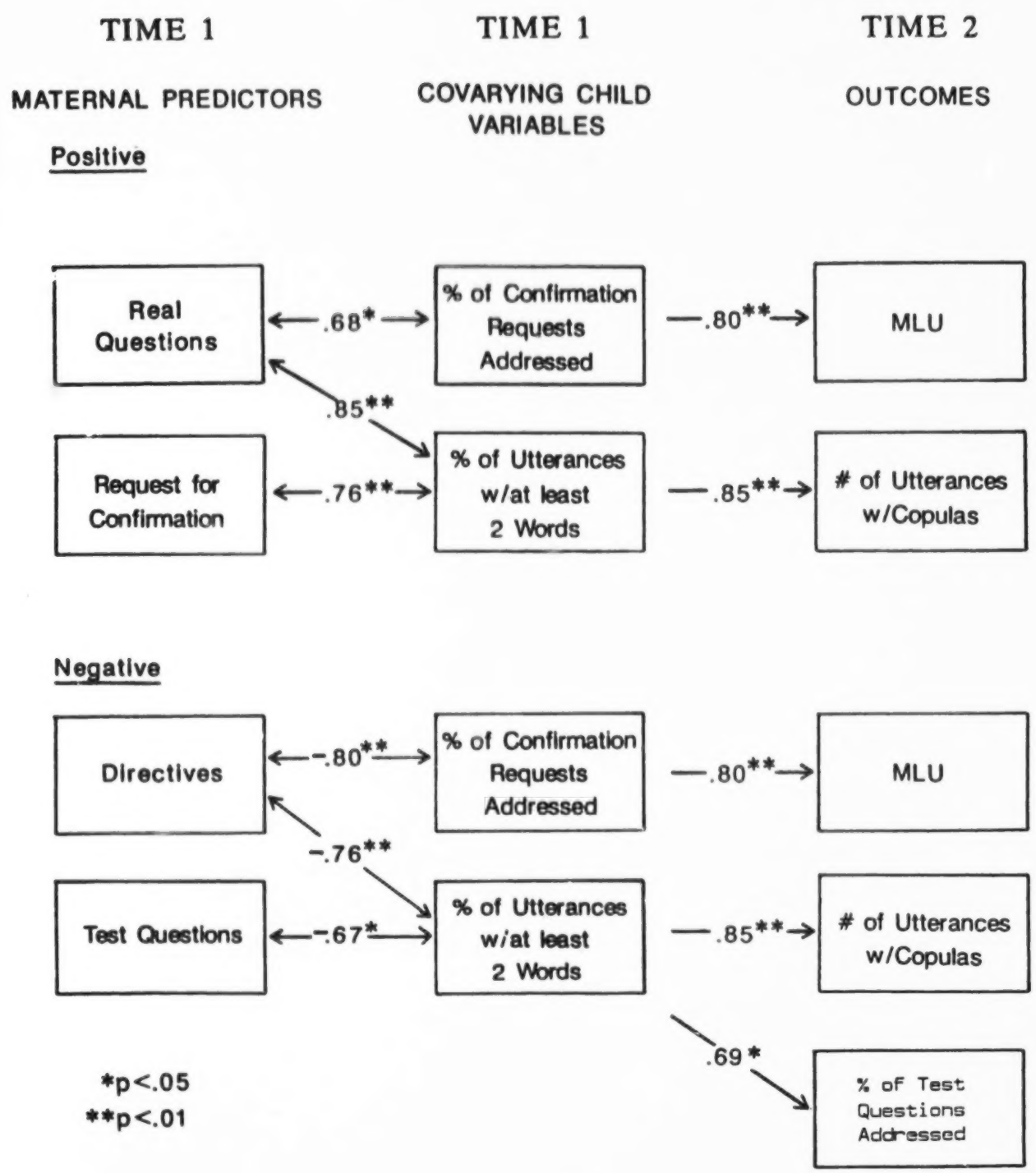


Figure 2

Possible Latent Cumulative Influence of

Maternal Test Questions at Time A - 1

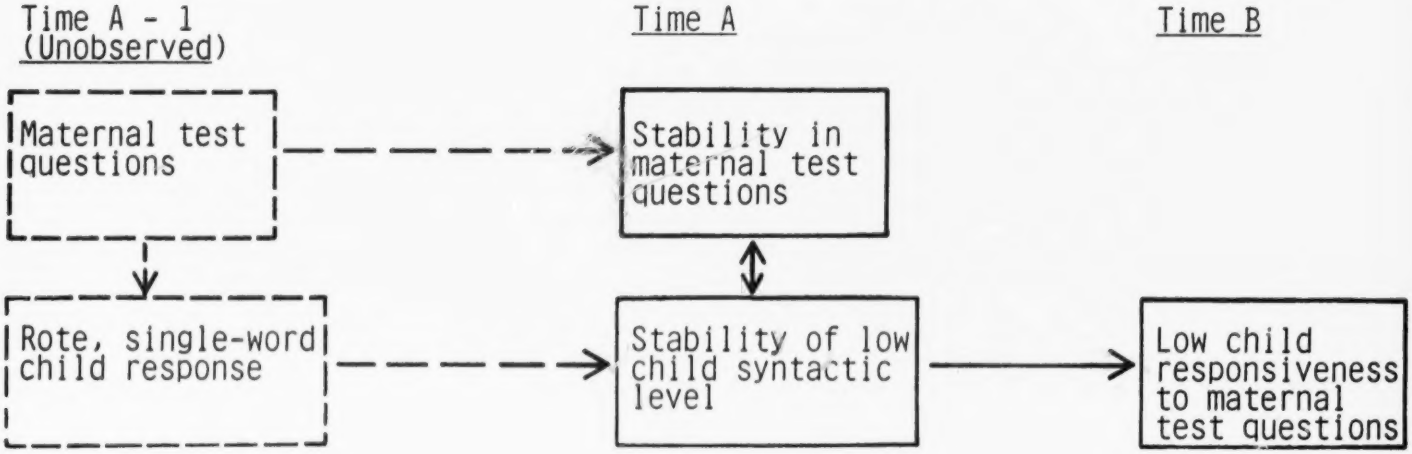


Figure 3

Possible Latent Cumulative Negative Influence of Low Child Syntactic Level and Motivation to Converse at Time A - 1

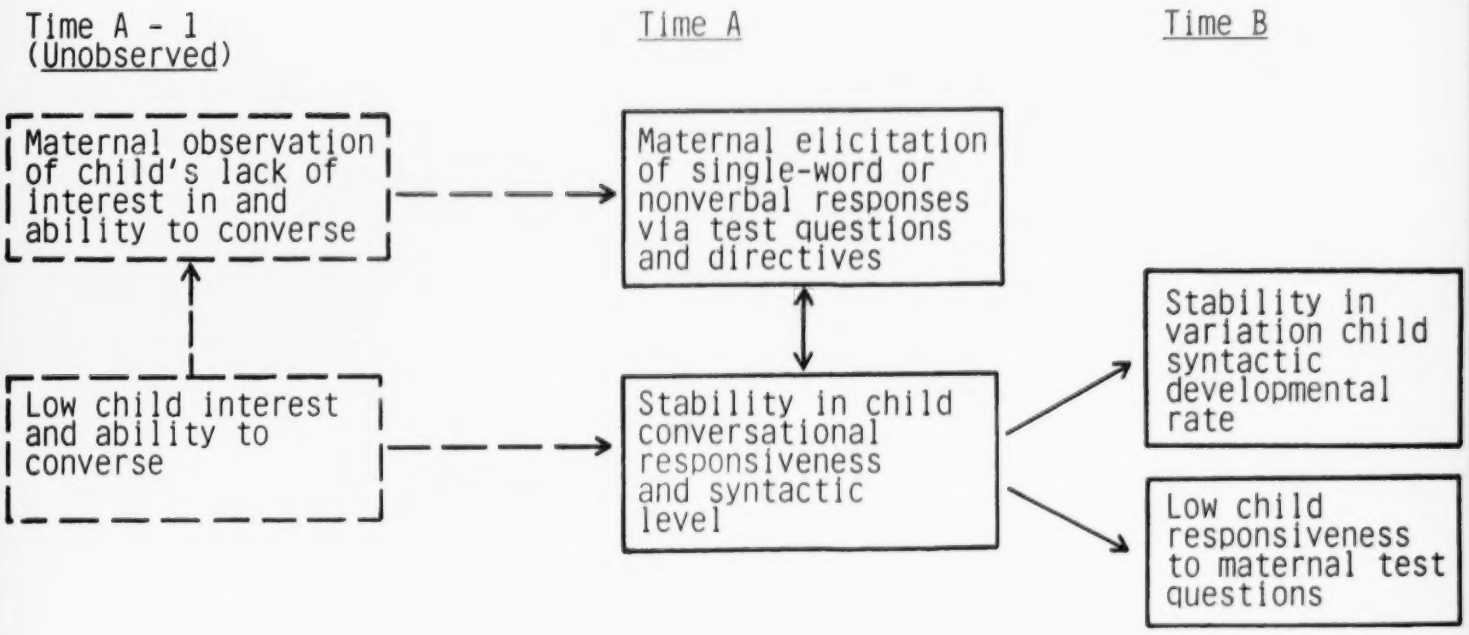

Time A - 1
(Unobserved)
Time A
Time B
Maternal observation of child's lack of interest in and ability to converse
Maternal elicitation of single-word or nonverbal responses via test questions and directives
Low child interest and ability to converse
Stability in child conversational responsiveness and syntactic level
Stability in variation child syntactic developmental rate
Low child responsiveness to maternal test questions

Figure 4

Possible Latent Cumulative Positive Influence of High Child Syntactic Level and Motivation to Converse at Time A - 1

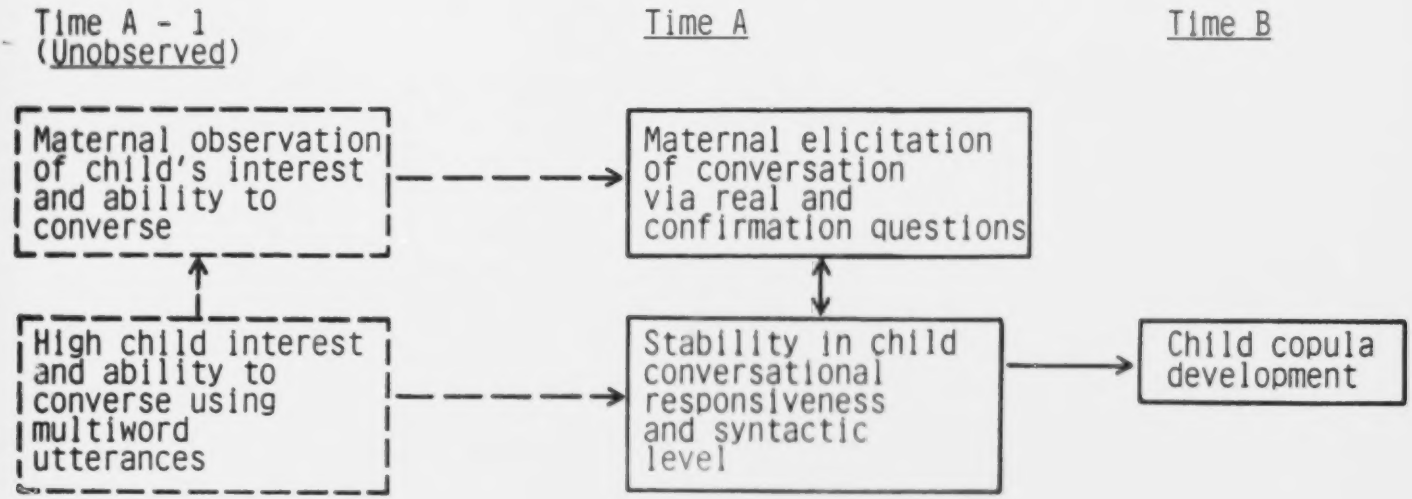
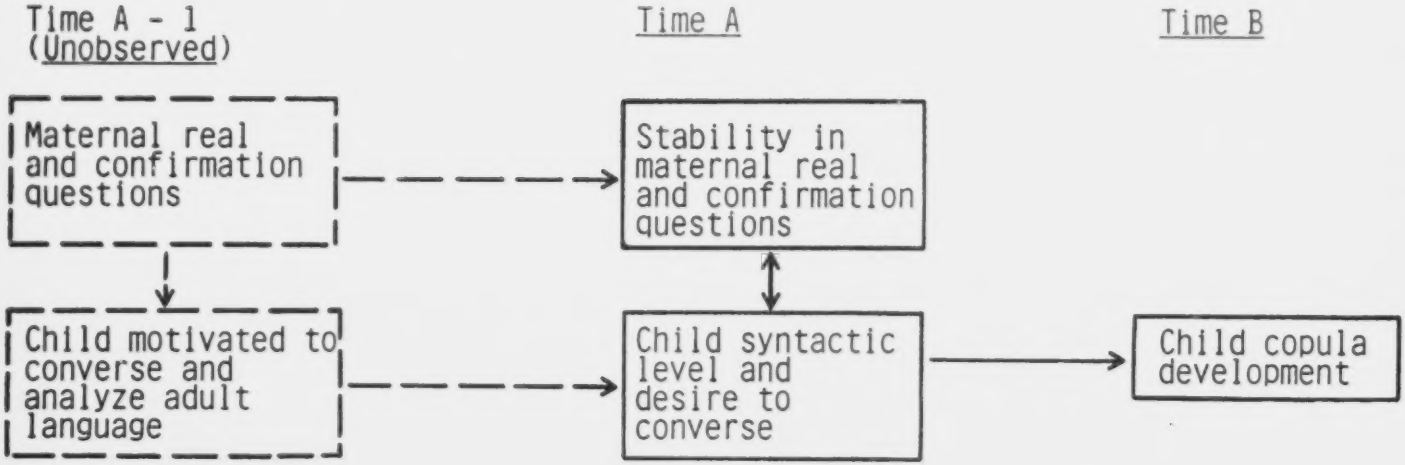

Time A - 1
(Unobserved)
Time A
Time B
Maternal observation of child's interest and ability to converse
Maternal elicitation of conversation via real and confirmation questions
High child interest and ability to converse using multiword utterances
Stability in child conversational responsiveness and syntactic level
Child copula development

Figure 5

Possible Latent Cumulative Influence of Maternal Real and Confirmation Questions at Time A - 1


Time A - 1
(Unobserved)
Time A
Time B
Maternal real and confirmation questions
Stability in maternal real and confirmation questions
Child motivated to converse and analyze adult language
Child syntactic level and desire to converse
Child copula development